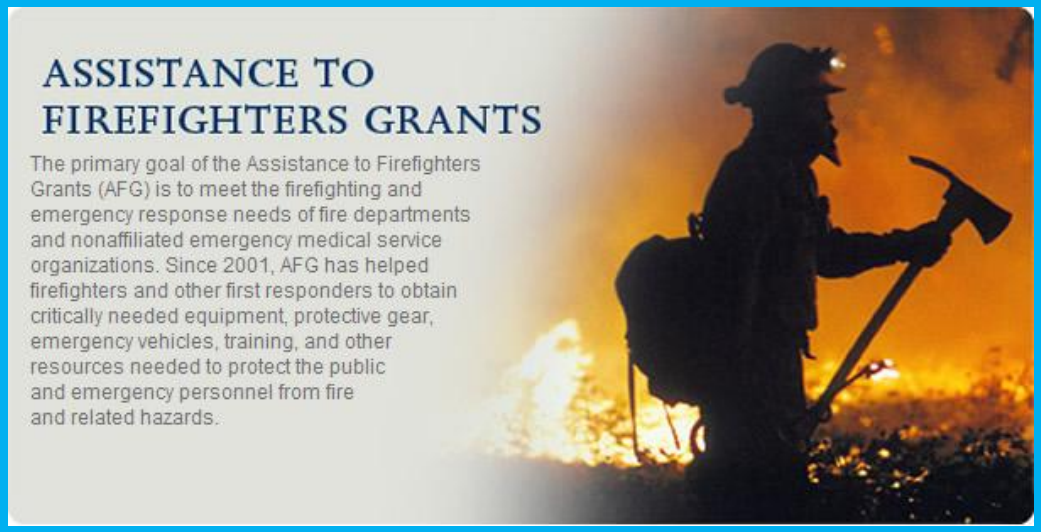
General AFG Communications Project Information



A $1,750,000 Public Safety Grant was awarded on March 3, 2010
(requires 20% match - $2,327,876 total project budget)
Project end date October 2012

Includes:

- Fresno Fire Department
- North Central Fire Protection District
- Fresno Police Department
- City of Clovis
- County of Fresno

Enhances systems funded by other grants such as:
Metropolitan Medical Response System (MMRS),
Public Safety Interoperable Communications (PSIC), and
Urban Area Security Initiative (UASI) Grants

Introduction

In 2010, it was recognized that the City would be required to replace our public safety two way radio system by 2013 to meet the narrow banding requirements of the Federal Communications Commission. The majority of the existing fixed radio system was installed in 1984 so no part of the radio system could be re-used. As funding for any project in today's austere fiscal environment is difficult it was realized this project must have display as many benefits as possible. This project is not only an interoperability project but it also is a badly needed technology refresh. The new system takes advantage of state of the art IP network connectivity and network management tools providing meaningful and user friendly tools appropriate to fire, police, and network maintenance technicians.

Overview

An Assistance to Firefighters Grant award of $1,750,000 funded equipment using new technologies embracing convergence and unified communications to add survivability, low maintenance cost, and meaningful interoperability features to a new radio system replacing our public safety radio systems.

The project can be best understood by viewing it in four main categories.

The four categories are:

1. Fire Radio System
2. Police Radio System
3. Real Time IP Network
4. Interoperability System.

1. Fire Radio System

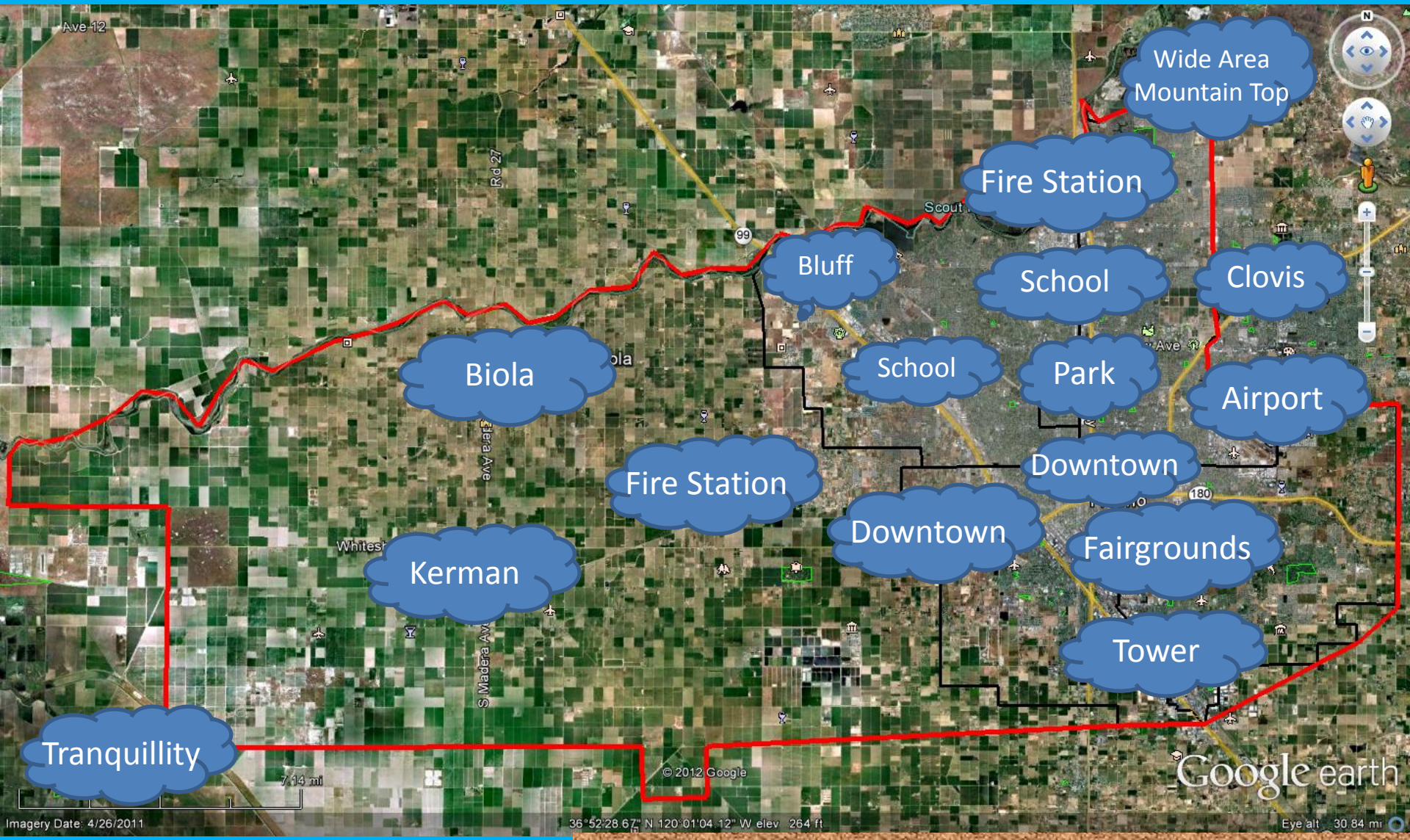
The Fresno Fire Department radio system consists of eight radio channels, with each channel having sixteen receivers located throughout their 350 square mile area of responsibility and linked together using a private, real time IP network. Each radio channel uses an individual receiver at these sixteen sites as listening posts for mobile and portable radio transmissions selecting the best signal from among the sixteen receivers. The radio system then rebroadcasts or repeats the signal from a powerful transmitter centrally located with the area of coverage. The selected signal is also sent to the dispatch center. This selection process takes place five times per second.

The next two slides list and show the locations of the sixteen receiver sites or listening posts.

Fresno Fire Department Radio Site Locations

Mountain Top (1,600 peak five miles north of the city overlooking our area)
Northeast, City of Fresno
City of Clovis
Northwest, City of Fresno
Town of Biola
Fresno County
City of Kerman
Fresno Unified School District Corporation Yard in Fresno City
California State University, Fresno
Central, City of Fresno
East, City of Fresno
Downtown, City of Fresno
County Site Downtown Fresno
Fresno County
Rented Site, Southeast Fresno
Town of Tranquillity

Fresno Fire Department Radio Sites



Fresno Fire Department Radio Sites

2. Police Radio System

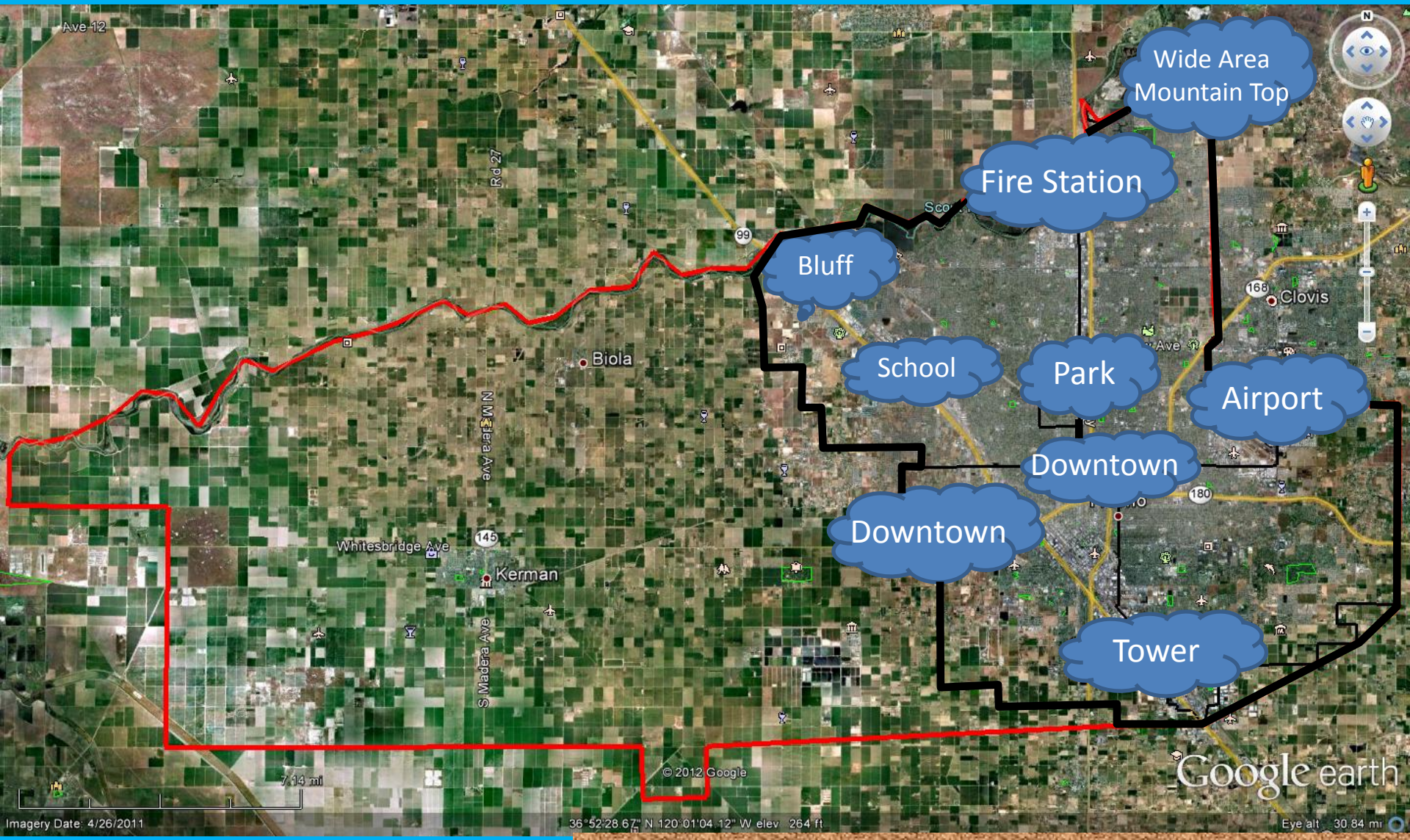
The Fresno Police Department radio system consists of thirteen radio channels with each channel having nine receivers located throughout their 105 square mile area of responsibility and linked together using a private real time IP network. Each radio channel uses an individual receiver at these nine sites as listening posts for mobile and portable radio transmissions, selecting the best signal from among the nine receivers. The radio system then rebroadcasts or repeats the signal from a powerful transmitter centrally located with the area of coverage. The selected signal is also sent to the dispatch center. This selection process takes place five times per second. A notable enhancement is an wide area channel transmitting from a sixteen hundred foot mountain just north of the city with a radio view extending nearly thirty miles north and south of the City of Fresno for mobile radio coverage.

The next two slides list and show the locations of the nine receiver sites or listening posts. These nine sites are co-located with Fresno Fire Department receivers

Fresno Police Department Radio Site Names and Locations

Mountain Top (1,600 peak five miles north of the city overlooking our area)
Northeast, City of Fresno
Northwest, City of Fresno
Fresno Unified School District Corporation Yard in Fresno City
Central, City of Fresno
East, City of Fresno
Downtown, City of Fresno
County Site Downtown Fresno
Rented Site, Southeast Fresno

Fresno Police Department Radio Sites



Fresno Police Department Radio Sites

Receiver Sites

The following slide shows the equipment installed at a typical receiver site. Each site is packaged a little differently to match the needs of the surroundings. The site shown is a combined fire and police site located at Fresno Unified School District. This site is a new addition to our radio systems and the school district is a new partner in our operations.

Fire and Police Receiver Site at Fresno Unified School District

3. Real Time IP Network

A real time IP network is necessary to connect the radio receiver sites and ACU-2000 IP devices. Real time IP networks run special protocol to ensure data packets arrive in the right sequence to be processed and eventually reconstruct the analog audio from the radio receivers in this system. Real time IP networks require special knowledge and experience beyond that of most IP network engineers to understand the network of switches, routers, firewalls, and gateways necessary to design and operate a real time IP network while maintaining network security. Radio data is sent throughout the network in less than 25 milliseconds. The difficulty in achieving this level of performance is often underestimated and often causes new installations to fail. Our network was successfully designed, engineered, and constructed in house building on experience gained from an earlier Fresno Police Department project transporting full motion real time video with real time IP.

4. Interoperability System

The interoperability system is the part of the project that provides user interface allowing radio transmissions from the different departments and agencies to be connected to each other as necessary for specific events. It also provides a means to use a laptop computer quickly to provide most of the functionality of a radio dispatch console on scene in the field without special support equipment.

The interoperability system consists of four Raytheon ACU-2000 IPs networked with a real time IP network and controlled as a single unit with Raytheon software known as their Wide Area Interoperability System or “WAIS” and “WAIS Dispatch.”

The three parts of the interoperability system are:

4.1 ACU-2000 IP
4.2 WAIS software
4.3 WAIS Dispatch software

4.1 ACU-2000 IP

The ACU-2000 IP is a hardware device that connects directly to two way radio equipment in traditional analog fashion then converts the signal into a digital format. The ACU-2000 IP also provides a matrix to tie or patch multiple radio channels together and also makes the digital signal from each channel available for monitor or dispatch purposes with the WAIS and WAIS Dispatch Software. Nine radios are attached to each one of our ACU-2000 IPs.

The next three slides show one of the four ACU-2000 IPs in the Fresno network, the two mobile units, and a high level diagram showing the four ACU-2000 IPs. The fixed site shown in the first slide is at Radio Park. The second slide shows Fresno Fire Department Engine Eight, the Fresno Fire Department Communications Unit, and the Fresno Police Department Mobile Command Center deployed to an event in the City of Sanger. The third slide is a high level diagram showing how the four ACU-2000s connect to form a complete interoperability network.

Radio Park Radio and ACU-2000 IP Equipment

Fresno Fire and Police Communications Units Deployed in Sanger

Fresno AFG ACU-2000 IP/WAIS Network

Wireless Connections

Wireless IP 4G Network Connections AT&T or Verizon

ACU-2000 Equipment Fresno Fire Mobile Communications Unit (mobile installation)

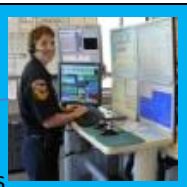
VHF Fire Mobile Radio | UHF Police Mobile Radio | VHF Fire Mobile Radio | VHF Fire Mobile Radio | UHF Police Mobile Radio | UHF Police Mobile Radio

ACU-2000 Equipment Fresno Police Mobile Communications Unit (mobile installation)

VHF Fire Mobile Radio | UHF Police Mobile Radio | VHF Fire Mobile Radio | VHF Fire Mobile Radio | UHF Police Mobile Radio | UHF Police Mobile Radio

Dedicated IP connection to Verizon

Private IP Network Connections Microwave & Fiber Optic



Private IP Connections

Secure VPN Connection

ACU-2000 Equipment Radio Park (fixed installation)

4 wire E&M Links

ACU-2000 Equipment Clovis Public Safety (fixed installation)

Fresno Fire Channel

Fresno Fire Channel

Fresno Fire Channel

Fresno Fire Channel

Clovis Fire Channel

Clovis Fire Channel

Fresno Police Channel

Fresno Police Channel

Fresno Police Channel

Fresno Police Channel

Clovis Police Channel

Clovis Police Channel

4.2 WAIS

The WAIS software is run on a PC or laptop computer to give remote access to the ACU-2000 IP network. The WAIS workstation can command the ACU-2000 IPs to patch channels together or break those patches down.

The next two slides show the screen of a laptop running WAIS demonstrating how a patch between Fresno Police Department, Clovis Police Department, Fresno Fire, Fresno Sheriff, and Fresno County Emergency Medical could be accomplished. The first slide shows the whole screen and the second shows detail of the patch area of the screen.

Example of Interdepartmental/Interagency Radio Patch using the Raytheon ACU-2000 IP

Example of Interdepartmental/Interagency Radio Patch using the Raytheon ACU-2000 IP

This example shows a patch connecting the following radio channels:

Fresno PD Channel 2
Clovis PD Channel 5
Fresno Fire Channel 2
Radio 4 in the Fresno Police Mobile Command Center (Could be a Fresno Sheriff's Channel)
Radio 9 in the Fresno Police Mobile Command Center (Could be an EMS Channel)

4.3 WAIS Dispatch

The WAIS dispatch software is run on a PC or laptop computer to give near dispatch center functionality by remote access to the ACU-2000 IP network. The WAIS dispatch workstation can accomplish most of the radio dispatch functionality available at fire and police dispatch centers. This is done by real time IP connection to the network of ACU-2000 IPs.

The next slide shows the screen of a laptop running WAIS dispatch. Eighteen channels of Fresno PD, Clovis PD, Fresno Fire, North Central Fire, Clovis Fire are available on the screen as well as Radio 9 of the Fresno Police Mobile Command Center (MCC). The MCC has an ACU-2000 IP with a total of nine radios attached that can be set to many other channels and accessed as needed. The MCC would be positioned near a major event if needed. The Fresno Fire Communications Unit has the same ability. Both mobile ACU-2000IPs can be accessed remotely using WAIS and WAIS dispatch workstations.


WAIS Controller - Raytheon JPS Communications
SITE LIST
ACU CLOVIS
ACU FIRE COMM VEHICLE
ACU POLICE MOBILE COMMAND CENTER
ACU RADIO PARK
TALK
DISPATCH
OVERVIEW
LOCAL
MENU
#
View:
All Sites
No Sites
Selected or Monitored Only
DSP3 1. FPD 1 ACU RADIO PARK
DSP3 2. FPD 2 ACU RADIO PARK
DSP3 COR 3. FPD 3 ACU RADIO PARK
DSP3 4. FPD 4 ACU RADIO PARK
DSP3 5. FPD 5 ACU RADIO PARK
DSP3 6. FPD 6 ACU RADIO PARK
DSP3 7. FPD 7 ACU RADIO PARK
DSP3 8. FPD 10 (WIDE AREA) ACU RADIO PARK
DSP3 9. FFD FIRE 1 ACU RADIO PARK
DSP3 1. CLOVIS FIRE 1 ACU CLOVIS
DSP3 2. CLOVIS FIRE 2 ACU CLOVIS
DSP3 COR 3. CLOVIS PD 1 ACU CLOVIS
DSP3 4. CLOVIS PD 3 [WIDE AREA) ACU CLOVIS
DSP3 5. CLOVIS PD 5 ACU CLOVIS
DSP3 6. FRESNO FIRE (METRO) ACU CLOVIS
DSP3 7. FRESNO FIRE (COMMAND) ACU CLOVIS
DSP3 8. FRESNO FIRE (FIRE 2) ACU CLOVIS
DSP3 9. VFIRE21 (WHITE NET) ACU CLOVIS
DSP3 9. RADIO 9 ACU POLICE MOBILE COMMAND CENTER
LOG OUT
admin